

REMARKS/ARGUMENTS

The above-identified patent application has been reviewed in light of the Examiner's Action dated October 10, 2007. Claims 1, 5, 8, 10, 18 and 21 have been amended. Claims 2-4, 6, 9, 12-17 and 23-25 are canceled, without intending to abandon or to dedicate to the public any patentable subject matter. Accordingly, Claims 1, 5, 7, 8, 10, 11, 18-22 and 26-30 are now pending.

The Examiner has rejected Claims 1, 5, 8, 10, 11, 18-22, and 26-30 under 35 U.S.C. § 112 1<sup>st</sup> paragraph for failing to comply with the written description requirement. Additionally, Claim 1, 8, 11, 19-21 and 26-29 are rejected under 35 U.S.C. § 103(a) as being unpatentable over JP-2002-325355 to Sugawara ("Sugawara '55") in view of "Recent Progress in Sic Power Device Developments and Application studies," April 14- 17, 2003, Cambridge, UK, pp. 10- 18 by Sugawara et al. ("Sugawara '03"). Claims 1, 5, 7, 10, 11, 18 and 19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sugawara '55 in view of JP 9-148681 to Tato ("Tato"). Additionally, the Examiner has rejected Claims 21 and 30 under 35 U.S.C. § 103 as being unpatentable over Sugawara '55 in view of United States Patent Application Publication No. 2003/0213979 to Nakajima et al ("Nakajima"). In order to establish a *prima facie* case of obviousness under § 103, there must be some suggestion or motivation to modify the reference or to combine the reference teachings, there must be a reasonable expectation of success, and the prior art reference or references must teach or suggest all the claims limitations. (MPEP § 2143.) However, all of the elements of the claims as amended cannot be found in the cited references, whether those references are considered alone or in combination. Accordingly, reconsideration and withdrawal of the rejections of the claims as obvious in view of the cited references are respectfully requested.

Initially, the Applicants' representative would like to thank the Examiner for the courtesies extended during the telephonic interview, which took place on February 8, 2008. During the interview, Applicants' representative discussed amending the claims to again recite a temperature of 125°C, in order to overcome the written description rejections. Additionally, the Applicants' representative emphasized the patentability of the claimed invention in view of the recitation of "stacking faults resulting from basal plane dislocation," which was added as a claim element by amendment in the response filed August 27, 2007.

In the interview, the Examiner indicated that amending the claims to recite a temperature of 125°C would overcome the new matter rejection. Regarding the distinction over the prior art provided by the recitation of "stacking faults resulting from basal plane dislocation," the Examiner indicated that he did not regard this claim element as reciting a structural limitation. Here, the Examiner and the Applicants' representative discussed amending the independent claims to recite language such as "including," in order to more particularly claim this aspect of the invention as a structural element. In that regard, the Examiner requested that the written response include an indication of where in the specification support can be found for this aspect of the claimed invention. No agreement on patentability was reached during the interview. The claim amendments set forth above include amendments to the claims, as discussed during the interview. Additionally, the following remarks summarize the arguments put forth by the Applicants' representative during the interview. As discussed in the interview, the following remarks also repeat portions of the arguments put forward by the Amendment and Response filed August 27, 2007.

Claims 1, 5, 8 and 18 are amended to again recite a temperature of 125°C, in order to overcome the written description rejections. Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. § 112 1<sup>st</sup> paragraph are respectfully requested. Claims 1 and 18 are amended to more particularly claim the present invention. In particular, amended Claim 1 and 18 recite "stacking faults *including* basal plane dislocation." As amended, it is believed that Claims 1 and 18 recite this aspect of the present invention in a sufficiently structural manner. Accordingly, as set forth in greater detail below, reconsideration and withdrawal of the rejections under 35 U.S.C. § 103(a) are respectfully requested. Additionally, it is noted that in canceling Claims 23-25, the Examiner's constructive election is acknowledged. However, Applicants reserve the right to pursue Claims 23-25 in a subsequent divisional application. Claim 21 is amended to remove a typographical error.

As requested by the Examiner, the following indicates the location in the specification and drawings of support for the claim element "stacking faults *including* basal plane dislocation." In particular, this claim element is based on the paragraph starting on page 18, line 16 and ending on page 19, line 24 in the English translation that corresponds to paragraph 0027 of

PCT/JP2004/011936. Additionally, it is noted that Fig. 1, as amended on August 27, 2007 (supported by the above-cited portions of the specification), shows two stacking faults, each of which is denoted by a reference sign IX. As noted in the Amendment and Response filed August 27, 2007, it is well known to those skilled in the art that stacking faults are formed in parallel with the basal plane *i.e.* (0001) crystal face according to their property. For example, the (0001) crystal, not shown in Fig. 1, is inclined 3 to 8 degrees with respect to face n-type semiconductor region 2 and p-type semiconductor region 3. Therefore, stacking faults IX are also inclined 3 to 8 degrees with respect to n-type semiconductor region 2 and p-type semiconductor region 3. Please note that, in Fig. 1, the scale in a longitudinal direction is enlarged in comparison to the scale in a transverse direction.

As stated above, the following repeats portions of the arguments first put forward in the Amendment and Response filed August 27, 2007. In the Office Action, the Examiner states that in view of the teachings of Sugawara '03, one having an ordinary skill in the art at the time the invention was made would be motivated to modify Sugawara '55 by incorporating a heat sink, so as to reduce the built-in potential and lower total power loss of as taught by Sugawara '03 (page 15, left col., first par.). However, the crystal defects discussed in Sugawara '03 differ in important respects from the stacking faults associated with the claimed invention. In particular, in the amended claims, the wide-gap semiconductor and accordingly the wide-gap bipolar semiconductor element have stacking faults including basal plane dislocation.

It is true that stacking faults are one type of crystal defect as the examiner states. However, other crystal defects not resulting from basal plane dislocation, for example, micropipes, spiral dislocations, threaded dislocations, carrot defects and the like do not have the property that their regions spread out as a current passes over them. On the contrary, as is shown in Figs. A1 to A2 below, stacking faults including basal plane dislocation have the property that their regions spread out in a fan-like or triangular shape in a plane parallel to the basal plane as current passes over them. As is shown in Figure B1, each of the stacking faults that has spread out becomes an obstacle on the current path, resulting in an increase of the ON voltage.

Fig. A1

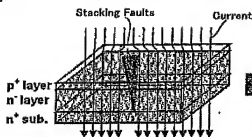


Fig. A2

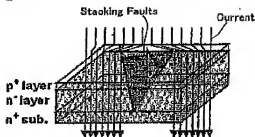


Fig. B1

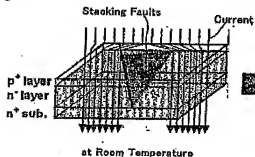
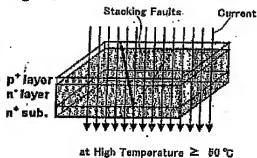


Fig. B2



For additional information regarding basal plane dislocation and stacking faults the Examiner is referred to "Propagation of Current-Induced Stacking Faults and Forward Voltage Degradation in 4H-Sic PiN Diodes", Materials Science Forum Vol. 389-393 (2002) pp. 427-430 by R.E. Stahlbush et al. The Stahlbush document was submitted concurrently with the Amendment and Response of August 27, 2007 in an information disclosure statement.

The claimed invention is based on the technical idea that adverse effects due to the stacking faults resulting from basal plane dislocation can be prevented by heating said semiconductor element at a temperature of 125°C or more. Adverse effects prevented by the claimed invention include an increase of the ON voltage and destruction of the semiconductor element. As is shown in Figure B2 above, at the temperature of 125°C or more, the stacking faults resulting from basal plane dislocation performs as if they were not present, resulting in no increase of the ON voltage.

In Sugawara '03, there is only a description that "The Sic pn diode has a higher built-in potential, but it can be reduced by increasing the device temperature with a very compact heat

sink," (See page 15, left col., first par.). This description just discloses an idea to reduce the ON voltage by decreasing the built-in potential utilizing the temperature characteristics of the wide-gap semiconductor, and does not disclose any idea to reduce the ON voltage by resolving the adverse effects due to the stacking faults resulting from basal plane dislocation. As described above, the defects such as micropipes in Sugawara '03 do not have the property that their regions spread out as a current passes over them. Therefore, based on the combination of Sugawara '55 and Sugawara '03 one of ordinary skill in the art would not come up with the idea to prevent the increase of the ON voltage and destruction of the semiconductor element having stacking faults resulting from basal plane dislocation by heating the semiconductor element.

Therefore, even if Sugawara '03 is combined with Sugawara '55, the claimed invention is not taught, suggested or described. Moreover, Tato also does not disclose the stacking faults resulting from basal plane dislocation, and therefore, does not disclose reducing the ON voltage by resolving the adverse effects due to the stacking faults resulting from basal plane dislocation. Therefore, even if Tato is combined with Sugawara 55, the claimed invention is not taught, suggested or described. Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. §103(a) of Claim 1 are respectfully requested. Moreover, with regards to Claims 5, 7, 8, 10, 11, 19-22 and 26-30, these claims are directly or indirectly dependent on amended Claim 1. Therefore, Claims 5, 7, 8, 10, 11, 19-22, and 26-30 should not be rejected under 35 U.S.C. §103(a). With regards to Claim 18, this claim substantially comprises all of the subject matter of Claim 1, although Claim 18 is an independent claim. Therefore, Claim 18 should not be rejected under 35 U.S.C. §103(a).

*Application No. 10/530,883*

The application now appearing to be in form for allowance, early notification of the same is respectfully requested. The Examiner is invited to contact the undersigned by telephone if doing so would be of assistance.

Respectfully submitted,

SHERIDAN ROSS P.C.

By: 

Brian J. Ignat  
Registration No. 57,174  
1560 Broadway, Suite 1200  
Denver, Colorado 80202-5141  
(303) 863-9700

Date: 2-11-2008